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Volume 1, 1978

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COVER PHOTOS—Junk cars never do much for the countryside. Kit Walther, Water Quality Bureau, discovered the scene on the front cover during a trip up a tributary of Spring Creek near Jefferson City, Montana. The back cover is how we like to think of Montana, unpolluted and pristine.

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ISSUES

The wave of enthusiasm for environmental protection which swept the nation a few years ago has broken, but, fortunately, the trough we now find ourselves in is not as deep as the original trough of apathy and ignorance.

When it is running, one must ride the wave of social reform as long as possible and establish program standards with great speed because, ultimately, the crest will break to a deep trough. What we can hope to do is establish a new plateau of social conduct and public acceptance higher than the previous norm.

While we must acknowledge that enthusiasm nationally—and in Montana—for environmental protection and sensibility is not as great as it was, there still remains a firm, deep-rooted and reliable conviction among the people of the state and nation that environmental protection indeed is a way of life that must be preserved and maintained.

health means wealth

THERE ARE NOW four billion of us on this earth. Within 35 years there will be eight billion. These numbers are more significant if we reflect that man's population did not reach a billion until 1830 A.D. One-fourth of all the people who have ever lived since pre-history are alive today.

In past centuries, a predictable rate of change was comfortable to manage, comfortable to think about and to plan for, but it no longer exists. Growth and depletion are accelerating at a rate that demands the greatest intellectual skill and awareness we can muster. Modern technology so multiplies the effort of one person that he or she can perform more work—and do more damage—than could a hundred or even a thousand persons a century ago.

The policy of the Environmental Sciences Division has been to maximize the freedom of the individual, while at the same time maintaining those qualities of life that are yet available. Woodrow Wilson indicated some years ago that the spontaneous cooperation of a free people is one of the greatest satisfactions of being an American.

In Montana we have demonstrated how effective cooperation and, sometimes, forceful implementation of a sound environmental process can lead to both prosperity and cleanliness. Filth and prosperity are not synonymous. If they were, during the Dark Ages we should have experienced the greatest economic advances in history, yet such was not the case. Air and water pollution control activities in Montana have provided jobs and been a source of revenue for merchants and others.

continued

ANSWERS

ON JANUARY 18, 1977 it was reported that, since the advent of the Clean Air Act in Montana, $66,192,763 had been paid to labor in Montana for the construction of air pollution control equipment and $20,271,914 in goods and services had been purchased from state businessmen.

During January 1, 1977 through December 31, 1977, an additional $30,100,000 was spent on air pollution control equipment. If it is assumed that at least 50 percent of this sum was for labor, this is an additional $15,050,000 for labor, and $4,515,000 for materials and equipment paid to Montana businesses.

In addition to the more than $30 million, $262,049 was spent on the performance of stack testing—which is labor-intensive—and about $394,000 on monitoring procedures, all performed by labor in Montana. Finally, technical studies performed by Montanans accounted for $104,250 for a grand total of $30,860,299 spent in Montana for the good of the state.

An expenditure previously not reported was the money spent for the construction of water pollution control facilities by municipalities in Montana. As of December 31, 1977, a total of $81,412,018 had been spent by municipalities.

The cost of water pollution control equipment purchased by industry in Montana is not easy to verify, but it has been estimated that more than $15,301,000 was spent prior to July 1976.

IN DETERMINING labor and material costs, it is generally conceded that both are higher for water pollution control facilities than for air pollution control. Using a figure of 65 percent for labor costs, municipalities and industry spent $62,864,000 for the construction of water pollution control facilities up to December 31, 1977.

It is absolutely absurd to assume that money spent for air and water pollution control will cause the disruption of the economy, and it continues to be a cruel hoax to pretend that we must choose between pollution control and prosperity.

Of greater interest is the fact that an additional $102.6 million will be spent for municipal water pollution facilities by fiscal year (FY) 1980. This three year expenditure will bring the total amount invested to more than $184 million.

By using the same estimate of 65 percent for determining labor costs, Montana working persons will be paid more than $66.7 million from December 31, 1977 to the end of FY 1980. Approximately 25 percent of the remaining costs or about $9 million will go for materials and supplies purchased from state businessmen. These costs do not include annual testing expenses, payment of taxes or annual operation and maintenance costs.

The annual operation and maintenance costs for industrial water pollution control for five major Montana industries amounted to $804,000 from 1970 to 1975. This money was almost all spent for labor, which in turn resulted in much of the money being spent in Montana, thus benefiting the state's economy.

Pollution control, indeed, has brought prosperity to thousands of Montanans and good health to us all.

THE TOTAL AMOUNT of air and water pollution control money spent in Montana for labor and materials is no small sum. It has been the life-blood for a great many people and has enabled them to raise families, feed and clothe themselves and maintain a high standard of living.

The expenditures for pollution control equipment continue to work for Montanans and will do so for many decades. No single effort has had such a positive influence on the health and welfare of the state's population as has the money invested in air and water pollution control. Additionally, none of these investments in public health have or will cause any person, company or corporation to go out of business.

It is absolutely absurd to assume that money spent for air and water pollution control will cause the disruption of the economy, and it continues to be a cruel hoax to pretend that we must choose between pollution control and prosperity. Pollution control, indeed, has brought prosperity to thousands of Montanans and good health to us all.

Evidence continues to accumulate that the harmful effects of pollution on human health are not only serious, but even worse than we thought. We cannot justify or permit changes in laws that would constitute a retreat or relaxation of efforts to assure all Montanans of a wholesome and healthy place to live.

The problem of doing something about dirty air, dirty water and dirty food is still with us, and is likely to grow. Progress has been made, and more can be made if people will accept the truth that a clean environment and prosperity go hand in hand. Certainly we have proved they do in Montana.

—Ben Wake

radiology:

BENT and DENT spell safety

by Doug McDonald

As the field of medical radiology grows, so does the search for more efficient and safer radiological procedures.

In radiology, efficiency and safety are collectively referred to as quality assurance. Basically, this is an attempt to optimize and maintain the diagnostic quality of an image produced by a system, such as an X-ray unit, fluoroscope or an automatic film processor. If the image is not clear the diagnosis may be incomplete or incorrect. In the same manner, if a system is optimized, but one of the variables change and the change goes unnoticed, an imcomplete or incorrect diagnosis may result. Another important benefit of quality assurance is that it helps reduce the number of exposures necessary for a doctor to make a diagnosis.

Two quality assurance programs have been initiated in Montana on a statewide basis. The first started in the summer of 1974 and was called DENT (Dental Exposure Normalization Technique), then in 1977 the BENT (Breast Exposure: Nationwide Trends) program began.

DENT

The dual purpose of the Montana DENT program was to eliminate unnecessary exposure and improved radiographic images. It was designed to deal with dental intra-oral X-ray examinations, but provided some aid in improving extra-oral radiographs.

The success of the program has been achieved through the cooperative efforts of Montana dentists, the Department of Health and Environmental Sciences' (DHES) Dental Health and Occupational Health Bureaus and the U.S. Food and Drug Administration's Bureau of Radiological Health (FDA/BRH).

Background studies in other parts of the country revealed that where X-ray beams penetrated the skin the exposure ranged from 100 to more than 5,000 milli-Roentgens (mR) per film for intra-oral X-ray examinations. This great range of exposures prompted the BRH to conduct a study to determine what exposures were needed to produce quality dental radiographs. Selected

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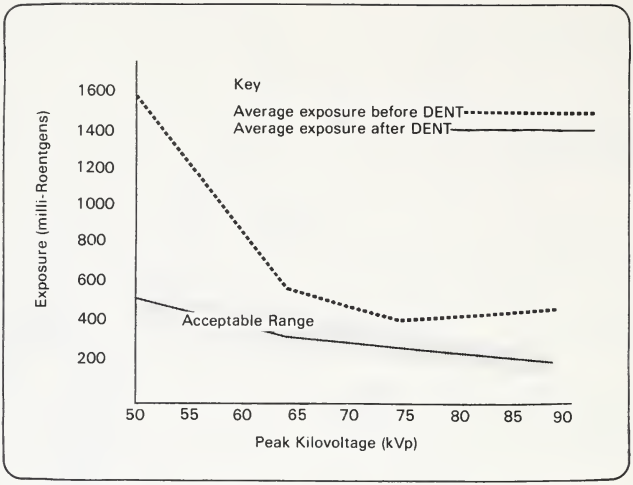


Figure I Comparison of Dental X-ray Exposures in Montana Before and After the DENT Program.

peak kilovoltage (kVp) settings from 50 to 90 were used to make radiographs of varying densities. A panel of dentists then viewed the radiographs and established a range of exposures at each kVp setting which produced acceptable radiographs.

Pilot studies in Rhode Island and New Hampshire found 45 percent of the known dental X-ray units were exposing above established ranges. These offices were visited by state personnel and new techniques established. These techniques reduced the average exposure from one-fifth the former value, in addition to maintaining or improving the diagnostic quality of the radiograph.

Once the interest was established and the initial studies done, the DHES began the DENT program by mailing X-ray exposure cards to dentists throughout the state. The dentists X-rayed the cards, then sent them back to the DHES. The exposure information was used to determine if the X-ray unit was exposing in excess of the recommended ranges. Of the 550 cards mailed, 520 were returned. The cards represented 390 participating dental offices.

X-ray Exposures

Fifty-six percent of the returned cards indicated X-ray exposures above the recommended range. Forty-nine percent of the 390 participating offices had one or more X-ray units producing exposures above the established ranges.

Dentists were told if their X-ray exposure exceeded advisable levels. Those recording readings above the recommended ranges were notified by the DHES that department representatives would help them bring the exposures into normal ranges.

During the office visits the state officials measured the radiation at the end of the pointer cone, the beam filtration, the beam diameter and the timer accuracy and reproducibility. The darkroom was also inspected for light leaks, safelights, thermometers and proper timers. Darkroom techniques were evaluated to determine if films were processed according to the recommended time-temperature method.

At the end of each survey, radiographs of a simulated human jaw or a phantom were made using the dentist's old technique and then by using the suggested method. With few exceptions, dentists selected the film exposed according to the suggested technique as being better than, or at least equivalent to, the film made using the old method.

The effectiveness of the Montana DENT program in reducing patient exposure is demonstrated in Figure I. On the average, a patient would receive a 528 mR skin entrance exposure for a bitewing film before the implementation of DENT. After completion of the DENT program, the average exposure for the same procedure was 288 mR—a reduction of 45 percent.

To gain some perspective of the overall effectiveness of the DENT program, some mathematical estimates

continued

were made to sum up the total exposure reduction. A conservative estimate indicated enough exposure was saved per week to produce more than 37,000 individual films at a 90 kVp technique of 130 mR per film.

The primary phases of the Montana DENT program have been completed. The normalization service is still offered to any dental office in the state. Maintenance of the program will continue and future assessments will be made to verify whether or not exposures are remaining in the recommended ranges.

BENT

Mammography, (the radiographic examination of breasts) has been used as a diagnostic procedure since the late 1920's. There was brief enthusiasm for the procedure into the early 1930's, but because of poor film images, interest subsided. Enthusiasm was rekindled in the late 1950's. With the renewed interest, new imaging sytems have been developed and mammography is now a popular diagnostic tool.

There is considerable controversy surrounding mammography, most of which comes from the risk-benefit question. The BENT program is not concerned with this controversy nor does it try to answer any of the controversial questions. BENT does provide an efficient mechanism to:

1. Determine the status of mammography in Montana.
2. Compare this status with the rest of the nation.
3. Identify those units which have unusually high or low exposures.
4. Recommend corrective actions leading to the improvement of mammographic practice.

Additionally, BENT reduces unnecessary exposure to patients from mammographic procedures; provides physicians with nationwide data on current mammographic practices, and provides information to help refine X-ray systems, resulting in improved mammograms.

Early national studies revealed a large range in mammographic techniques and exposures. Of major concern was radiation exposures from 0.025 Roentgens (R) to 47 R. The range and magnitude of these exposures prompted further investigation, pilot studies and finally the formulation of BENT.

With the information from the pilot studies, and cooperation of film companies, research groups and radiologists specializing in mammography, the FDA/BRH was able to establish criteria that served as a basis to evaluate mammographic techniques. These criteria will vary as new information becomes available, but they serve as a recommended level to minimize exposure and optimize the final image.

Personal Contact

Phase I, or the part of the program where physicians performing mammography were located, contacted and asked to cooperate, was done by personal contact in Montana. Initially, 23 facilities indicated they were doing mammography or were at least interested in participating in BENT.

Second Phase

In the second phase, cards containing a thermoluminescent dosimeter (TLD) were mailed to the facilities that indicated interest in the program. The cards were exposed with a technique typically used for a craniocaudal view of a medium-density, medium-sized breast, then sent back to the BRH to be read. From the information on the cards, the BRH was able to measure the radiation exposure delivered to patients during mammographic examinations. This information enabled the BRH to determine whether the techniques used by a particular facility conformed to recommendations or could be improved.

The 23 Montana facilities all returned their cards, with three indicating they no longer performed mammography. Of the remaining 20, techniques used by nine were questionable.

Due to the small number of facilities doing mammography and the potential benefits, it was decided to conduct the Phase III demonstration at all participating facilities.

During Phase III, a representative from the DHES measured patient exposure and parameters affecting the X-ray beam quality. With this information, the investigator was able to discuss techniques and make recommendations to doctors and technologists. Actual films were produced using special phantoms and various techniques to compare image quality. In 13 of the 20 facilities, technique changes were made that improved the final image.

Continuing Program

The BENT program is a continuing program. It will be offered to facilities that are performing mammography. As new information is generated and becomes available, both in Montana and throughout the country, this information will be made available through BENT. A re-evaluation will be conducted later to evaluate changes in mammographic practices.

Programs such as BENT and DENT have been successful because they fulfill a need. Today new products and techniques become available and are put into use so rapidly, many times information about the product or technique lags. BENT and DENT serve as vehicles to bring information to the users and demonstrate researched and accepted techniques. These programs have demonstrated their effectiveness in optimizing radiographs while minimizing exposure to patients.

The DHES is studying and planning several other quality assurance programs in medical radiology. A program in film processing quality assurance has already started. In this program X-ray technologists perform daily, weekly and monthly checks on film from the processor. When properly employed, this program evaluates and controls the entire film processing system.

Other programs being considered are more specialized and require special equipment and expertise. It is hoped these programs may be incorporated on a spot check or trouble shooting basis.

BILLINGS — 1973

photograph by RONALD J. SCHLEYER

Tightening the Clean Air Act

by Jerry Schneider

For the past few months the Department and Board of Health and Environmental Sciences (DHES) and (BHES) have been considering several challenges and proposed revisions to the Montana Clean Air Act Rules to clarify the enforceability of the rules.

The Montana Clean Air Act (MCAA) was adopted in 1967, prior to the approval of the 1967 Federal Clean Air Act Amendments. The amendments gave the states 90 days to notify the Department of Health, Education and Welfare (HEW) and 180 days to set and adopt standards. The Montana statute on the other hand allowed the Board of Health only 90 days to set standards. Due to the lack of federal ambient air quality standards and the time frame, it was not surprising that enforcement of the adopted standards was not fully understood or appreciated at the time. Presently, there is no lack of confidence in the validity of the figures adopted in 1967, but there is a question of enforceability.

Clean Air Act

According to the Environmental Protection Agency (EPA), the state is responsible for adopting legislation and enforcing rules to meet the ambient standards set forth in the Federal Clean Air Act. The state has three basic enforcement alternatives:

1. The adoption of emission regulations to assure compliance (the EPA approach);
2. The issuance of enforcement orders to assure compliance; and
3. The initiation of a civil or criminal action in district court for the collection of a penalty as provided in the act.

To utilize any of these alternatives is difficult if standards are called "desirable goals."

There are two basic terms used in connection with air pollution that tend to get confused or juxtaposed. The terms, "standards" and "criteria", are defined by a U.S. Senate subcommittee as follows:

> Air quality standards are a way of implementing air quality criteria *as actual requirements for performance by polluters or potential polluters. Air quality standards are prescriptive; they prescribe pollutant levels that cannot legally be exceeded* during a specific time in a specific geographic area. *An expression of public policy rather than scientific findings, their development from air quality criteria will be influenced not only by a concern for the protection of health or welfare, but also by economic, social and technological considerations.* Criteria, on the other hand, are: . . .an expression of the scientific knowledge of the relationship between the various concentrations of pollutants in the air and their adverse effects on man, animals, vegetation, materials, visibility and so on.
> *Air quality criteria can and should be used in developing air quality standards. Criteria and standards are not synonymous.* (emphasis added)

Air Quality Standards

In the State Ambient Air Quality Standards (Rule S14040), standards and criteria are occasionally used interchangeably, resulting in confusion as to the intentions of the BHES. Additionally no prohibitive statement indicating that no persons shall cause, suffer or allow a certain emission or pollutant level to occur was included. The BHES then added the following paragraph:

> The Board, in adopting these standards, intends them to be goals and guidelines and so interprets the legislative intent of the word standards in Section 69-3909 of the Clean Air Act of Montana.

This paragraph established a conflict with the federal definition of the word standards.

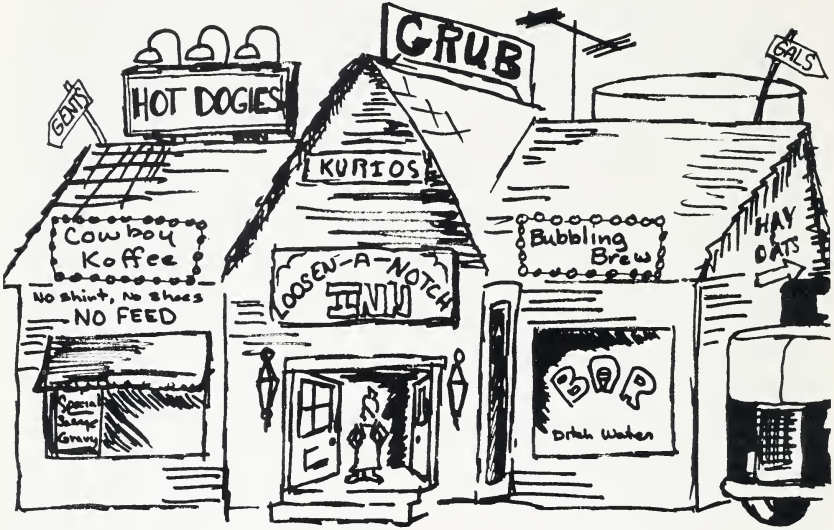
The Montana Air Pollution Control Advisory Council (APCAC) reached a consensus that ". . .standards as used in the law shall be defined as goals and guidelines." It appears from the testimony given that the BHES was also in consensus and that ". . .these standards, once adopted, will form the basis for regulation, which will have the force of law."

After considering the enforcement question, the department and board decided to consider all the ambient standard issues in an appropriate rule-making proceeding.

The DHES feels that an appropriate rule-making proceeding scheduled in late June or early July would allow enough time to prepare an adequate technical and scientific basis for a revised ambient air quality rule, yet still allow enough time to coordinate it with the requirements of the Federal Clean Air Act Amendments of 1977.

Whatever the decision, it is a critical one, both for public and industry, and the sooner resolved, the sooner progress can be made in retaining and attaining the clean, healthful environment considered traditional in the "Big Sky Country."

Be Your Own



Restaurant Inspector

by Jim Peterson, R.S.

If you are like most Americans, you are eating more and more meals away from home. Statistics indicate that one of every three meals is now being served by some type of commercial food service establishment, and if the present trend continues, the ratio will soon be one in two.

The menus offered to you are varied, and you can choose the basic hamburger, sample the exotic offerings of a gourmet outlet or pick almost anything in between.

Most of the time your dining experiences are pleasant. You enjoy tasty meals served in pleasing surroundings by competent people. But not always! You can have a sorry experience, be subjected to unsanitary conditions and practices, and become very ill. You cannot escape this risk, because the food you eat and drink, the knives, forks, spoons, cups and glasses, and even the table, counter or bar surface can be carriers of disease-causing organisms, toxic residues, or hazardous chemicals.

YOUR FIRST LINE of protection against these hazards is your health departments. Sanitarians employed by

continued

counties, cities and the state are continuously making inspections of all food service establishments. The inspections are designed to discover problems with equipment, procedures and practices which are a hazard to the health of the customer and employee. The sanitarian corrects the problems through education, training, persuasion, and if necessary, legal enforcement, and as a last resort, closure.

But things happen fast in food service establishments, and conditions may change hourly.

The sanitarian obviously cannot be there constantly, so you the consumer must help protect yourself by being your own food service inspector.

Before we consider how and what to inspect and evaluate, it is necesary to know more about what we are trying to prevent; so let's consider in more detail the hazards to your health caused by unacceptable food service sanitation practices.

Food poisoning is a broad term applied to illness acquired through the consumption of contaminated food or water. It includes illness due to chemical contamination, toxic substances produced by growing bacteria and bacteria themselves.

CHEMICAL CONTAMINATION of food is caused by the introduction of chemicals into or on foods due to accident, carelessness or confusion. Prevention is a matter of tending to business when using hazardous chemicals; storing chemicals so spills and leaking will not contaminate foods; labeling chemicals so that they are not confused with non-hazardous food additives, and by using only non-hazardous containers for food storage.

Bacterial contamination is a more complex problem. As living animals, bacteria are found almost everywhere. They move about by hitchhiking and are found by the thousands on unclean surfaces and unwashed hands. They are on the feet of flies, cockroaches, mice and rats. A cough or sneeze, clothes, hair and dust help them spread themselves about. They are normal residents in the nose and are found in pimples, infected cuts and skin rashes.

From any of the many contamination sources, bacteria can get in and on foods where they begin to grow. Given moisture and a temperature between 45° Fahrenheit (F) and 140° F., bacteria reproduce themselves rapidly. Under proper conditions, they simply divide themselves into two bacteria, and can do this every 15 to 20 minutes. Using this process, a single bacteria can grow to approximately 8,796,000,000,000 bacteria in 12 hours.

Eating foods contaminated with large numbers of bacteria can make you sick. The symptoms are headache, nausea, stomach cramps, vomiting and diarrhea, and may occur in varying degrees of severity. The symptoms are caused either by the sheer numbers of bacteria introduced into the body or by the toxic substances bacteria produce while living and growing.

The prevention of illness due to bacterial contamination, obviously, is accomplished by controlling the bacteria themselves. This can be done by following three simple rules:

- First, keep foods clean and covered.
- Second, keep food at 45°F. or below. Cold temperatures do not kill bacteria, but slow their growth and will keep their numbers below that which causes illness.
- Third, keep food 140°F. or higher. Hot temperatures kill most harmful bacteria.

There is a third hazard to your health present in food service establishments. Food, silverware, cups, glasses, counters, doorknobs—almost anything in the establishment—can be the vehicle for many communicable diseases. The waitress with a sore throat who touches her mouth and then the rim of your glass passes her illness to you. The customer with a cold who coughs and sprays his bacteria and virus-laden saliva over the uncovered pies and cookies, which you then order, is giving you his illness. The doorknob on the inside of the public rest room which has been touched by hundreds of people who do not wash their hands after using the facility can pass to you untold miseries. The possibilities for disease transfer are great, but the risks can be reduced.

The sanitarian obviously cannot be there constantly, so you the consumer must help protect yourself by being your own food service inspector.

Surrounded as you are by illness hazards when you enter a food service facility, what are your defenses? What can you do to help your local health department sanitarians protect your health? How can you assure yourself that you will be at least as healthy after you eat and drink as you were before? The answer is to observe what is going on, to evaluate practices and procedures, to order foods wisely, to demand sanitary conditions, and to let the owner or manager know when things are wrong.

Food service sanitation inspectors have rule books, inspection forms and guidelines to assist them in evaluating food service establishments. The following items are things you can check, points you can consider, and guidelines for you to follow.

continued

— Does the waitress grasp your glass of water by the rim and leave you no place to drink without touching her finger prints?

— Does the waitress or cook handle your **food with their fingers, thus giving you what bacteria he or she has via the food they serve?**

— Is the public rest room clean, or is the filth so obvious you refuse to use the fixtures?

— Are paper towels and soap available at the handwash sink and a covered waste receptacle provided?

— Is the rest room ventilated or is there an obnoxious odor present?

— Is the rest room equipped with an automatic self-closure on the door, or can odors and flies move readily into the food and drink area?

— Is food left uncovered and thus being contaminated by dust, hair, flies, roaches or rodents?

— Are the food service employees wearing hair restraints? Clean uniforms?

— Are the food service employees smoking on the job and thus getting bacteria ladened saliva on their hands whenever they handle their cigarettes?

— Do the food service employees exhibit poor personal habits by scratching, picking or blowing their nose and then not washing their hands?

— Are employees eating while they are on duty, thus exposing their hands to mouth contamination and then transferring their germs to you by not washing their hands?

— Are the menus clean, or covered with bacteria-laden grease and food particles?

— Are the tables and counters clean, or can you see a film of grease, dirt, old food or dust?

— Are the glasses and cups clean, or are the lip prints of previous users evident?

— Are single-service articles, such as straws, toothpicks, spoons, forks and hot and cold cups protected, or are they exposed to flies, dust, germs and the fingering of the customers?

— **Are the dishes free of cracks and chips which trap and hold bacteria and filth?**

— Can you smell cooking throughout the establishment and see grease collections on the ceilings and walls?

— Are the floors clean and without cracks and flaws?

— Is the cloth used to wipe the table, booth, or counter clean?

— Are there animals in the food facility? Only seeing-eye dogs are permitted.

— Is there a crust on the salad dressing, around catsup and mustard bottles, and on salt and pepper shakers?

— Is the coffee cream, either real or synthetic liquid creamer, refrigerated?

— Did you notice garbage piled outside the rear door in an uncontrolled manner?

— Are there flies and other insects present in numbers beyond the isolated few?

— Does the waitress have her thumbs in your soup, salad or gravy when serving?

— Are hazardous foods such as cream pies, custards, and cream puffs left unrefrigerated and allowed to grow millions of food poisoning bacteria?

— Is hot food hot when served, or is it cold, indicating it has been at a hazardous temperature? Is cold food cold when served, or is it warm and thus has been at hazardous temperatures?

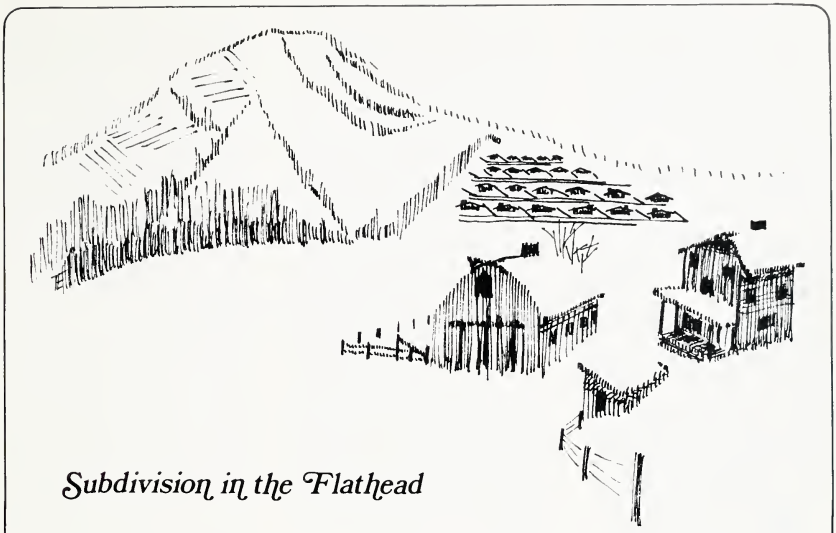
— Are there corners, shelves and cupboards which are filled with extraneous items which provide a holding place for insects and rodents?

— Are persons who have no legitimate business in the kitchen or behind the counter?

— Are dead insects around cans near food, indicating a danger of chemical contamination?

Now that you know the problems and some of the things to look for, don't let your knowledge keep you from frequenting food service establishments. Instead, we hope you'll avoid ordering food you find not being properly protected and not being held at proper temperatures. We hope you'll express your dissatisfaction to the manager and you will notify your health department of problems observed.

Everyone concerned will benefit from your efforts. The health department gains your evaluating services, the business gains protection against loss of business due to sick and dissatisfied customers, and you, the consuming public, will receive more healthful food served in a sanitary manner in a clean and wholesome environment.



Subdivision in the Flathead

Fantastic future or the freight

by Wilbur O. Aikin, P.E.

Not many years ago there was an amusing anecdote about a young gandy dancer who found himself engaged in a series of track repair jobs in a long railroad tunnel. As he methodically went about his business he suddenly became aware of a faint glow from the far end which left him fearfully wondering if he was seeing the distant sunlight at the end of the tunnel—or a slow moving freight train.

The Flathead River Basin citizenry and the young fellow trapped in the tunnel are somewhat mired in the same predicament because of a sudden realization and fear for their long-term future. Are today's and yesterday's land developments really the forerunner of an improving economy, or are the valley and its people experiencing the immediate advantages of a land boom that will ultimately result in great cost to both the land and people?

Winning the West

This question looms larger day by day because land development is occurring at a rate that would have been declared fanciful a mere 10 years ago. Decisions are being made and precedents established for accelerating expansion. This is being paired off in rhetorical battle against a bright and carefree optimism aimed at getting on with the latest phase of winning the West—remote corners included.

How far has this really gone? No one really knows!

Consider, if you will, that we are talking about an area the size of Massachusetts which is managed by a broad spectrum of "governing authorities," each with their own set of objectives which are seemingly based on maintaining territorial imperatives. Overlay this with at least three contending major cultural groups, innumerable local political interests and add the influencing factors associated with the truth that the biggest fish in the tank is the U.S. Government.

Without knowing what is really happening and what has happened, any attempts to make a determination of either adverse or beneficial impacts becomes a very speculative proposition which

continued

swings back and forth between witch hunt emotionalism and "good ole boy" opportunism. Nobody is keeping score because nobody has the authority, manpower or time to tally up the bottom line.

Of course, anyone familiar with the law of the land, Montana version, will be quick to point out that such problems are not a fit subject for a state agency to ponder because land use decisions—including their impact offspring—are only within the jurisdiction of those same governing bodies previously alluded to. While true, the state has maintained a toe-hold in that process by retaining decisions regarding sewage disposal, domestic water supply, solid waste and stormwater runoff. This has been accomplished in the name of public health and water quality protection by means of a law now known as the Sanitation in Subdivisions Act (69-5001 through 69-5010, R.C.M., 1947).

Subdivision Activity

State involvement in Subdivision affairs began in 1961 and although modified by successive amendments, a paper residue of compliance with that law remains the closest thing to a comprehensive, long term overview of subdivision activity in any given part of Montana.

In the beginning the law and regulation were viewed more as a guideline because an underdeveloped state has plenty of room for both error and the common sense approach. Today the law is much more rigid and compliance has improved, primarily due to the serious involvement of many local county health departments. There are many problems remaining, however, most are related to the fact that a more specific law requires a more rigorous interpretation and enforcement which quickly escalates into a manpower problem.

In the Flathead all of the above is true, but the biggest underlying problem now is the fact that those areas amenable to quick and easy development are either going or gone, leaving a growing pressure for the continued development of lands which are not particularly well suited for residential or high density use, except at high cost—a factor which usually defeats the purpose of creating the subdivision in the first place.

Decisions

The problem can be appreciated much more clearly when it is understood that a lake front foot, *any* lake front foot, on Whitefish, Flathead, Swan, Echo, Blaine, etc., can have a potential market value in the range of $200.00 to 700.00 per linear foot, and even land exhibiting obvious environmental constraints can be conveyed for as much as 10 to 15 thousand dollars per acre. Every decision, small or large, has become of monumental economic significance to someone, somewhere. In a land of lakes, rivers, orchards, scenic forests, mountains and broad vistas the potential for development is boundless providing the statutory aspects of the law can either be complied with or neutralized. The line becomes very hard to hold if the proposed division is not a subdivision subject to review under the Subdivision in Platting Act, but instead is an occasional sale. It is not unusual for an old timer, after a lifetime of hard work in agriculture or forestry, to cut out a piece of property for sale, only to find himself trapped in environmental constraints placed on him by strange, unfamiliar and, to him, unfair laws. But the law must be evenhanded, even for old timers, and the pressure builds.

As a contrast to the present, turn back to 1969, the year the Department of Health and Environmental Sciences (DHES) opened its branch office in Kalispell. Subdivision work was then viewed as a subordinate preoccupation, with the office priority placed more on water quality, community sewage, community water supply and related complaints or field inspections.

During 1969, 11 major subdivisions came into being, creating some 225 lots on approximately 150 acres. All had sanitary restrictions placed on them *after* being filed in compliance with the 1969 law. Interestingly enough, some of these subdivisions still have sanitary restrictions attached, a circumstance the reader can reflect on regarding any property he or she might own in the valley.

Legal Definition

It must also be understood that the definition of the word "subdivision" then differed considerably from the current legal definition. It was not difficult for knowledgeable individuals to create new tracts or lots by other means, legally accomplishing a division of land without the disadvantages inherent in filing a true platted subdivision.

Therefore, the new number of lots or tracts created in 1969 were not known and could not be known without an exhaustive survey of the 1969 records in at least two different clerk and recorder's offices. Experience gained since then suggests that a grand total of 400 to 450 lots or tracts were probably created in the Flathead Valley during 1969. Approximately 15% of those lots were served by community facilities, the rest to be provided with individual water supply and sewage disposal systems.

From there the level of activity has crept constantly upward until in 1977, 50 subdivisions, creating 500 lots on 800 acres, were approved by this office. Because this level was not much greater than during 1969, the question immediately becomes, "What land boom?" The answer to that lies in those subdivisions created as exemptions to the Subdivision in Platting Act. A total of 973 Certificates of Survey were filed in Flathead and Lake counties during 1977. Approximately half of the certificates passed through this office and received reviews in accordance with the Sanitation in Subdivisions Act. It would have to be assumed that those not seen by this office or the planning organizations were exempt from both the Subdivision and Platting Act and the Sanitation in Subdivisions Act. However, there was no simple way to verify this assumption

continued

except on a case by case basis since neither the local governing body, the DHES nor the county health departments had the authority to review such exemptions for purposes of validating any attendant declarations of exemption. Several of these individual Certificates of Survey were extremely large, consisting of an entire section or sections, with all lots slightly in excess of twenty acres.

Numerous Proposals

The overview of true subdivision for this calendar period was also incredibly distorted due to the fact that numerous proposals evaluated at the local level by the planning agencies during 1977 have not been formally submitted to the DHES.

The Flathead Valley county planning organizations processed 81 true subdivision proposals during 1977. Because only seven were disapproved there is a clear indication that concurrent review is extremely unpopular with developers.

In retrospect, it appears the legislature wanted a law based on parallel review so any lag time would be reduced. But practically speaking, it appears many developers are voluntarily hedging their bets by forcing the review schedule into a series procedure which strings the ultimate approval out over a much longer period of time—but which can prevent wasted evaluation costs.

If the valley planning organizations were asked about 1977 they would say it was a big year (1770 lots on 2300 acres) for true subdivisions alone, *plus* those 973 exempted Certificates of Survey creating an additional untold number of lots.

Figures

If the Subdivision Bureau is asked the same question regarding the same valley for the same year, the answer in terms of platted subdivisions is much more moderate. As previously noted, bureau figures indicate about 50 subdivisions with 500 lots on 800 acres were created, plus approximately 500 Certificates of Survey.

Providing a bottom line to all this activity is fraught with "if's" and "but's," however, it seems probable that if the proposals that received local approval during 1977 are ultimately approved and if "remainders" from exemptions are included, then the year 1977 saw 4000 parcels, lots or tracts created, or remodeled for modern usage, within the Flathead River basin. Of those, at least 10% had residences on them already and the ground around them was the thing that changed.

Over the past years the average size of a lot has been in the 3.5 acre range. Since it is unlikely this has changed, much of the acreage involved is probably no less than 10,000 acres nor any higher than 15,000 acres.

Whitefish itself is unquestionably the busiest locale in the valley in terms of new subdivision activity. Virtually every tract of land between the city limits and the base of Big Mountain Road has either been submitted, is being prepared for submittal or has been taken to professional consultants regarding a submittal.

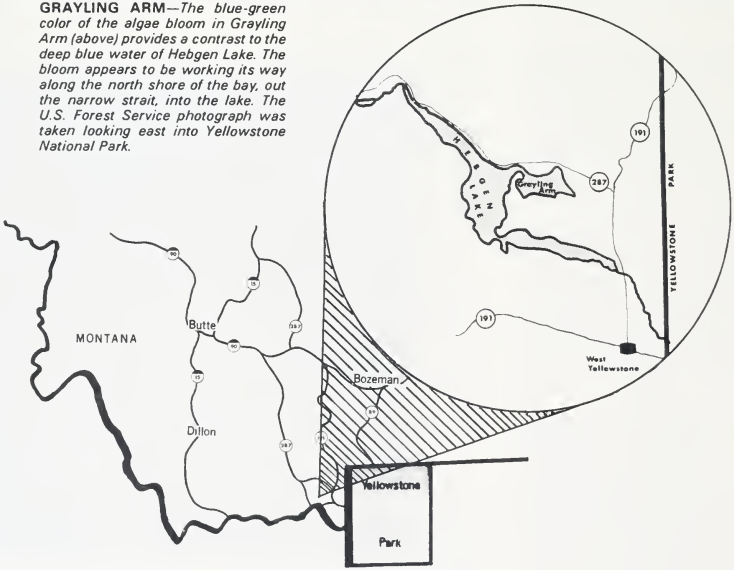
Added to this is the fact that Canadian people and Canadian interests have taken a great financial interest in the recreational and residential potential of the entire Whitefish area and it can be seen that Whitefish is experiencing an unprecedented land rush which is historically unique in Montana.

Land division, construction and recreation—at the moment, these are the moving and doing words in the Flathead. Unfortunately, the industrial base to support the growing multitude is little changed. Although few, there are some who are seriously concerned about the consequences of development without visible means of support. We still don't know if that's a light at the end of the tunnel or a big, lumbering freight. Perhaps somebody ought to put their ear to the track and find out.

photograph by AL KEPPNER

photograph by the U S FOREST SERVICE

GRAYLING ARM—*The blue-green color of the algae bloom in Grayling Arm (above) provides a contrast to the deep blue water of Hebgen Lake. The bloom appears to be working its way along the north shore of the bay, out the narrow strait, into the lake. The U.S. Forest Service photograph was taken looking east into Yellowstone National Park.*



GREEN CREATURES OF THE DEEP

or

(the Grayling Arm toxic algae bloom)

by Stephen P. Glasser, Loren L. Bahls
and Abraham A. Horpestad

This is the story of the first documented toxic algae bloom in Montana. It begins something like a low-budget science fiction movie, with the mysterious, threatening creature and the ensuing alarm and confusion. But it quickly develops into a model of intergovernmental communication, cooperation and action—an imperfect yet functional model. Like any good mystery, it has a bit of sleuthing, a large cast of characters and a happy ending. The lessons learned from the Hebgen Lake episode may be useful in years to come, so we thought it would be well to record the story here.

The Setting

Hebgen Lake is an impoundment on the Madison River just downstream from Yellowstone National Park in southwestern Montana (location map). It is heavily used for fishing, camping, swimming and water skiing. There are several Forest Service campgrounds and many private resorts on the lake shore.

Northeast of the main body of Hebgen Lake is a large bay called Grayling Arm. It is isolated from the lake except for a strait called "The Narrows," which is only a few hundred feet wide. Grayling Arm is fed by a few small streams. The combined discharge of the streams is much less than that of the Madison River running through the main part of the lake. In a drought year, as in 1977 when snowpack in the area was only 66 percent of normal, runoff into Grayling Arm is even less. The average depth of the bay—15 feet—is only half the average depth of the reservoir. Due to the isolation and shallow water, temperatures in the Arm are higher than in the main reservoir. (On July 1, 1977 the maximum recorded surface temperature in the Arm was 74°Fahrenheit (F), while the surface temperature of the main reservoir ranged from 59° to 68°F.)

The streams feeding Grayling Arm have a different chemical makeup than the Madison River, thus the Arm is not only physically but also chemically distinct from the main body of Hebgen Lake. The major ions in the Madison River are sodium and bicarbonate, while the major ions in the other tributaries are calcium and bicarbonate.

Opening Scene

On June 21, 1977, Assistant Forest Ranger Claude Coffin of the Hebgen Lake Ranger District, Gallatin National Forest, in West Yellowstone, received a phone call from Mrs. DeKeyrel of Bozeman. Her dog had become sick and died at the Rainbow Point Campground on the south shore of Grayling Arm. Mrs. DeKeyrel said her dog became ill after drinking some lake water near the boat ramp. The first reaction to the call was not to question the lady's concern or the fact her dog died, but that her diagnosis was incorrect. Surely, if the dog had died from some poison in the water, other animals, birds and fish would have been affected. Apparently this was not the case, so Mrs. DeKeyrel's theory was put aside and a different hypothesis developed. The preferred theory concluded that: someone in the vicinity of Rainbow Point Campground was poisoning dogs. Since poisonings posed a hazard to campground visitors, especially children, forest personnel gridded the entire campground area looking for the poison and cautioning all visitors about the poten-

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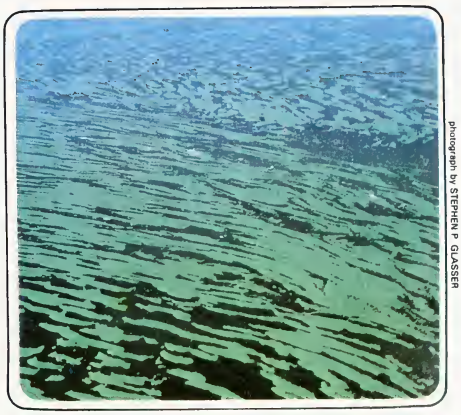


photograph by STEPHEN P. GLASSER

The Bloom

tial hazard. They found nothing.

The Plot Thickens

Follow-up work the next several days revealed three other dogs belonging to local residents also died after drinking lake water in the Grayling Arm area. Gallatin County Deputy Sheriff Bob Pearson had taken two of the dogs to the Animal Health Diagnostic Laboratory in Bozeman for autopsies. (This laboratory is operated by the State of Montana, Department of Livestock, Animal Health Division.) Tests for strychnine and "1080" poisons were negative, so the poisoning theory was discarded. But what about toxic algae? Maybe Mrs. DeKeyrel had something there after all.

Samples of lake water at Rainbow Point were taken Saturday, June 25 by ranger district personnel and sent to Forest Service Hydrologist Steve Glasser in Bozeman for toxicity testing. For help, he contacted Dr. David Stuart, Montana State University (MSU), director of Applied Research. Within minutes, Dr. Stuart called back and said Dr. James Cutler of the Microbiology Department would assist in testing the water.

The first samples contained mostly pine pollen and large green plants, and smelled terrible! They had not been refrigerated between collection on Saturday and delivery to Dr. Cutler on Monday morning. A second set of samples was collected June 27, put on ice, and delivered the 80 miles to the laboratory within four hours. They contained no green plants, but did have copious amounts of floating pea-green colored algae, and did not smell.

Dr. Cutler injected mice with water and algae from the June 25 and 27 samples, as well as with plain tap water and tap water acidified to the pH of the lake water. Mice receiving water and algae collected June 27 died within five minutes after injection, while all other mice survived beyond 16 hours. Further tests on centrifuged and filtered algae-free water did not harm the mice, but tests using the algae alone killed all the mice. Boiling for 10 minutes did not reduce the toxicity of the algae. Here at last was the apparent killer: a toxic strain of blue-green algae living in the water!

Exposing the Culprit

On June 27, the same day the toxic algae were first collected and confirmed as the cause of the problem, warning signs were posted around Rainbow Point beach by Forest Service personnel. On June 29, the algae was identified as **Anabaena flos-aquae** (pronounced Anna-bee-na floss-ak-wee) by graduate student Stephen Whalen and Professor John Rumely of the MSU Department of Biology. Dr. Edward King, Gallatin County health officer, was notified of these findings and the following day he met with Gallatin Forest Supervisor Gene Hawkes. After reviewing the situation, they decided to close Grayling Arm to swimming and water skiing until further notice. The order was issued July 1, just before thousands of tourists normally arrive for the Fourth of July weekend.

Late on June 30, fourteen head of cattle were reported dead on the north shore of Grayling Arm. Erick Armstrong of the Gallatin County Health Department investigated the report. He took stomach samples and lake water samples to see if the algae were responsible. Results showed that **Anabaena flos-aquae** was present in both the water and the stomach linings. Samples of algae recovered from the cow stomachs were injected into mice and the mice died.

The Hebgen Lake area contains a number of grizzly bears. After the algal-poisoned cattle were found, it was feared that grizzlies would move in to feed on the cattle carcasses and perhaps be affected by the meat or by drinking the lake water. They would also pose an added threat to the thousands of visitors in the area. The Yellowstone Interagency Grizzly Bear Research Team was contacted, and the team assisted in arranging for the removal of the carcasses by a rendering firm. No grizzlies or people were affected because of the action taken to prevent this potentially serious problem.

The Chase

By this time it was evident that a more coordinated effort was needed to avoid duplication of effort. Although almost no duplication had occurred to this point, it was an increasing risk. Thus, a bloom crisis committee was formed.

The local 208 water quality agency, Blue Ribbons of the Big Sky Areawide Planning Organization, volunteered its office for meetings and help in coordinating news coverage, which was becoming an increasingly important aspect of the whole affair. The committee consisted of representatives of the Gallatin County Health Department, Gallatin National Forest, Blue Ribbons of the Big Sky, Montana Department of Fish and Game, MSU and the Water Quality Bureau, Environmental Sciences Division, Montana Department of Health and Environmental Sciences. There was no overall coordinator, but it was decided that Abe Horpestad of the Water Quality Bureau would be sent the data and information because of his familiarity with Hebgen Lake and expertise in algae.

continued

photograph by F. GLEASON, The Journal of Freshwater

Anabaena flos-aquae

photograph by STEPHEN P. GLASSER

SAMPLING RUN—Ed Keller (far left) and Dick Juday from the University of Montana Department of Chemistry and Marti Keller were three of the many persons who worked together to identify the deadly blue-green algae that plagued Grayling Arm last summer. They are shown prior to taking samples at various points throughout the bay.

The committee met on July 1 and decided on a monitoring program. It included the following: (1) daily mapping of the bloom's location from the nearby Horse Butte Fire Lookout and periodic checking by aerial fire observers; (2) sampling the thickest portion of the bloom three times a week and testing for toxicity in Dr. Cutler's laboratory; (3) sampling water chemistry at The Narrows twice a week to determine nutrient status in Grayling Arm; (4) conducting a one-time aerial photographic flight over the Arm and adjacent waters using color infrared and color negative film to determine algae densities and circulation patterns; (5) mapping of the arm's bottom contours and determining its total water volume; (6) observing fish behavior, water temperatures, and dissolved oxygen levels periodically and (7) collecting fish livers for toxin analysis.

The Gallatin National Forest, Gallatin County Health Department and Water Quality Bureau were responsible for the first four items while the Department of Fish and Game handled the last three tasks. Within ten days of the meeting, all programs were proceeding smoothly. The results of the committee's monitoring programs will be published in a technical report being prepared jointly by the Water Quality Bureau and the Gallatin National Forest.

Finale

Closure signs were placed around the Grayling Arm shoreline on July 2. On July 6, the area around Yellowstone Holiday Resort was closed and the following day the eighth dog died, despite warning signs. On July 15, the algae moved out of the Arm along the north shore of the main lake, threatening several other resorts. The closures to swimming and water skiing were extended about 2½ miles westward along the shoreline. The bloom was observed moving out of the Arm and into the main body of Hebgen Lake on July 22. No further closures or warnings were issued.

The first non-toxic algae samples were obtained on August 1 and on August 5 the decision was made to cancel closures effective the following day. Toxicity testing was continued through August 21 by Dr. Cutler. On August 9-10, Dr. Wayne Carmichael, an expert on algal toxins from Wright State University in Ohio, made a survey of the lake and did not find any **Anabaena** algae. Two other blue-green algae were found, **Microcystis** (Mike-row-siss-tiss) and **Aphanizomenon** (A-fan-eye-zom-en-on). They were non-toxic in this case, although they also can produce toxins.

The known deaths resulting from the six week seige of algae were eight dogs and 39 head of cattle. Fish were apparently unaffected and did not concentrate the toxin in their tissues. Fortunately, no humans became ill or died from the bloom. Recreational use of the popular Rainbow Point Campground was down 40 percent due to the closures. Some of the privately owned resorts on Hebgen Lake, particularly those nearest Grayling Arm, lost business during the bloom, especially over the Fourth of July weekend. State, federal and local agencies invested 161 man-days and about $15,000 in direct costs.

Epilogue

Anabaena flos-aquae is a simple plant consisting of a short chain of microscopic cells laid end-to-end. Except for its green pigment, it is

continued

more closely allied with the bacteria than with other algae. When conditions are favorable the chains clump together and the plants are capable of doubling in number every 24 hours. When this happens the algae are easily visible to the unaided eye and the plant is said to bloom. The bloom looks something like green pea soup or green latex paint.

Blue-green algae generally occur at water temperatures above 60°F. The mean air temperature in the Hebgen Lake area for June 1977 was 6°F above normal and water temperature in Grayling Arm ranged from 65° to 74°F in July. Many species of blue-green algae, unlike other algae, are able to use nitrogen from the atmosphere as a nutrient. Thus, they are favored when the amount of nitrogen dissolved in the water is low. Like most other algae, the growth of blue-greens is stimulated by the addition of phosphorus. Phosphorus levels in Hebgen Lake in 1977 were greater than levels measured in prior non-bloom years.

Although algae blooms can occur anytime sufficient nutrients and suitable temperatures are present, the factors that cause toxin production are not understood. About a dozen species of blue-green algae can be toxic. The most persistent troublemakers are species of **Anabaena, Aphanizomenon** and **Microcystis.** One bloom may be just a smelly mess, while another bloom of the same species may be deadly. The two strains—harmless and deadly—look identical under a microscope.

Blue-green algae blooms have appeared frequently in Grayling Arm in the past. However, the bloom organisms have been identified only once before. In 1965 Danny Martin, then a graduate student at MSU, recorded blooms of three blue-green algae in Hebgen: **Anabaena** spiroides, (Anna-bee-na spy-roy-dees) **Aphanizomenon flos-aquae,** (A-fan-eye-zom-en-on floss-ak-wee) and **Lyngbya birgei** (Ling-bee-a birge-ee-eye). Of these, only **Aphanizomenon flos-aquae** is known to produce toxins. **Anabaena flos-aquae,** the alga that poisoned Grayling Arm in 1977, was not reported by Martin.

As the Hebgen Lake episode was subsiding, **Anabaena flos-aquae** was depositing trillions of tiny spores onto the bottom of the lake. Each one of these reproductive cells will be capable of producing a new plant this summer. They are also easily transported by currents through the dam and downriver to other reservoirs on the Madison and Missouri Rivers. The Water Quality Bureau will be monitoring phytoplankton populations on Hebgen Lake in 1978 and will also be keeping an eye on other reservoirs in the system below Hebgen.

Potentially toxic blue-green algae are by no means restricted to the Madison and Missouri River systems. Toxic blooms have occurred in the northern tier of states from Washington to Michigan and in the southern portions of the Canadian prairie provinces. A 1975 survey of stock ponds and streams in eastern Montana found potentially toxic species in 25 percent of the waters sampled. The seed is widespread and a bloom could develop anytime conditions are right. While there is no immediate cause for concern, citizens are advised to be alert to the threat of algae poisoning.

science non-fiction nightmare

What to do!

We sincerely hope that you will never experience a poisonous algal bloom, but if you do, here are some suggestions:

1. Determine if the species is a toxin producer. Collect a sample and have it examined immediately by a trained biologist. Most universities and the Water Quality Bureau in Helena have biologists that can identify a potentially toxic blue-green alga.

2. Determine whether the bloom is toxic. If there are affected animals around they will show signs of staggering, muscle spasms, labored breathing and convulsions. Death will occur from respiratory arrest, in anywhere from a few minutes in mice to several hours in cattle. There is no effective antidote. A very rigid neck is characteristic at death.

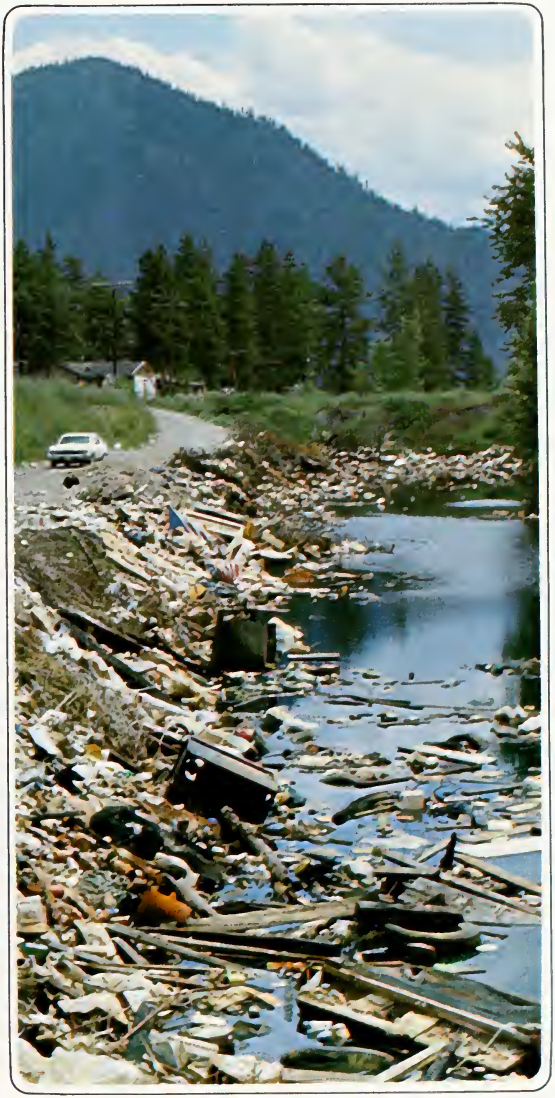
3. If you suspect toxic algae, contact your local health department for help. It in turn will contact the state epidemiologist and the Water Quality Bureau for further investigation. They are well trained and equipped to handle these matters; your job is simply to make them aware of the problem as soon as possible.

4. If you are a government employee, contact the State Water Quality Bureau (in Montana, call 406-449-2406) for assistance and be prepared to establish and maintain lines of communication, deal extensively with the news media, and generally spend a lot of time on the crisis. In a bound notebook, keep a chronological written record of events and observations as your bloom progresses. The earliest days are the most critical in avoiding over-reaction and unnecessary sampling and work. We feel that we succeeded in avoiding these pitfalls largely because of our frequent phone calls to one another and because we planned our actions once we knew what had to be done. What could have been a science non-fiction nightmare proved to be a very educational exercise in communication, cooperation and resource management.

Good Luck!

Garbage: the vast unused resource

by Bill Potts



photograph by PAT TRUSLER

It is often said solid waste, or garbage, is our only growing resource. In the past, the accepted waste management philosophy was out-of-sight, out-of-mind. Recently that well established theory has changed dramatically due to the environmental damage and serious public health problems created by improper disposal.

Solid waste represents the discards of our every day life and the many complex wastes generated by industrial activity. However, under certain conditions, much of these wastes can be reclaimed, thus greater attention is being given to the recovery of valuable materials from the steady stream of solid waste.

Quantity and Composition

Each year, millions of tons of waste are generated in Montana. These wastes are associated with

continued

photograph by the ENVIRONMENTAL PROTECTION AGENCY

PARADISE LOST—*There's irony even in garbage. The photo taken on page 19 was taken near Paradise, Montana several years ago. Like its companion picture (below) it shows the easy, unresourceful and hazardous way to dispose of garbage. Conversely, recovering metal (top, left) is a way to utilize and conserve valuable resources.*

photograph by the SOLID WASTE BUREAU

such activities as mining, agriculture and industry, as well as the household refuse produced by each and every citizen. Because of the serious environmental and public health hazards involved, immediate interest is being directed toward municipal and hazardous wastes.

It is estimated that 100,000 tons of hazardous material are discarded annually in Montana. These wastes include such things as heavy metals or other toxic substances, and discarded pesticides. Such wastes are dangerous to the environment and public health.

Currently, Montanans generate municipal wastes at an average rate of 4.3 pounds per person per day, or 600,000 tons per year. It is indicative of our affluent society that the waste generation rates are increasing at an annual rate of nine percent, thus by 1990 the amount will soar to nearly 800,000 tons a year.

We not only generate a great deal of waste, but also throw away a large volume of potentially valuable material. Of the 600,000 tons of municipal waste generated in 1976, approximately 78 percent could have been processed in recycling or resource recovery operations.

The solid waste we usually see as a sack of garbage each day is made up of many reclaimable materials. Refuse from a typical home or business includes: 48 percent paper, 8 percent metal, 6 percent glass, 16 percent garbage, 9 percent yard trimmings and 13 percent other material.

In 1976, 355,000 tons of the total processable wastes were combustible and available as an energy source. Additionally, approximately 36,000 tons of ferrous and 6,000 tons of non-ferrous metals could have been recovered.

Portions of some major materials are being recycled, but in terms of the percentage of total consumption, recycling has been static or declining. Only a small fraction of post-consumer waste is recycled. Some materials cannot be recycled, but percent rates of recycling could be increased substantially to supply a limited but important part of our total material needs.

Estimated Amount of Solid Waste for Montana, 1977

Waste Type	Tons/Year
Municipal (residential, commercial)	600,000
Wastewater Treatment Sludge	12,000
Industrial Solid Waste	4,600,000(est.)
Mining Waste	72,000,000
Forest Product Waste	13,000,000
Feedlot Waste	803,000

The issue, especially when considering the future, is two sided. How can the consumption of finite virgin materials be reduced and recycling encouraged without producing severe dislocation to our current way of life? And, how can the damage to our environment by the disposal of wastes be minimized?

Health and Environment

To most people the greatest impact of a dump is the visual blight it causes. But poor solid waste management practices are a serious threat to public health and the environment. Increasingly, surface and groundwater contamination, air pollution, fires, explosions, food chain contamination and odors are being directly attributed to improper solid waste disposal.

Contamination of groundwater and land from disposal sites has become a great concern throughout Montana and the nation. According to the Environmental Protection Agency (EPA), groundwater suplies almost half of all domestic water. Yet the contamination of this source is extremely serious because it is difficult to detect and control. In terms of effects on land, improperly disposed waste can cause serious damage by changing the land's biological and chemical nature, or introducing pathogenic organisms that can prevent or limit productivity.

Natural Resources

Our society consumes enormous amounts of material and energy, which in turn generates exceedingly large volumes of waste. We, as a nation, are continually increasing our per capita consumption of goods. It is estimated that by the year 2000, the United States' consumption of most raw materials will double.

Only a small amount of our municipal wastes are being recycled. The technology and methods for reclaiming materials from solid waste are available. Recycling and resource recovery techniques have been successfully employed worldwide for many years. Still, there appears to be a general reluctance to firmly employ these methods in a long-term committed manner.

Institutional and Technical Considerations

The proper management of solid waste has become a major, expensive and often complex problem for local governments and private industry. The technical aspects of solid waste handling and disposal are becoming more difficult, partly because of the growing variety and complexity of solid waste. Political considerations, competition for local tax revenues and natural conditions further complicate the search for reasonable solutions. Even in Montana, many communities and some industries have nearly exhausted land suitable for solid waste disposal sites. It is becoming increasingly clear that individual communities cannot always find satisfactory solutions to solid waste disposal problems. Also, it is evident that many "acceptable" waste management methods practiced by communities and industries in the state are not adequate to provide appropriate protection

continued

for the environment and public health.

The environmental damage from uncontrolled or improper disposal and the resulting consequences all represent "costs" to society. These costs are sometimes called "hidden" because they often do not show up in local governments' solid waste budgets, but rather are borne indirectly by society. An example of such hidden costs would be aesthetic costs which often cannot be easily measured in conventional monitary terms. These costs are very real and could be reduced by more extensive use of areawide waste management systems, recycling or resource recovery programs.

Government Response

Federal and state lawmakers in the last year and a half have enacted significant new laws which provide the key to solving many of today's waste management problems.

In October, 1976, the U.S. Congress passed the Resource Conservation and Recovery Act. The act outlines federal responsibilities for administering a natural solid waste management program. The act clearly states two broad goals which are essential to achieve an effective program. These goals are:

> *To assure that all solid and hazardous wastes are managed in a manner that will protect public health and the environment.*
>
> *and*
>
> *To conserve natural resouces directly and through the management, reuse and recovery of solid and hazardous wastes.*

The federal law clearly states a commitment to establish an effective national solid waste management program which will be an equal companion to existing federal programs dealing with air and water quality. However, contrary to federal action in the past, the Resource Conservation and Recovery Act places the burden of development and implementation on individual states. While the federal law does provide for a degree of assistance, it in effect requires each state to assume the responsibility for developing effective solid and hazardous waste management programs.

Montana Statutes

In December 1976, the Department of Health and Environmental Sciences (DHES) completed a two-year statewide solid waste management and resource recovery study. As a result of the study's findings and recommendations, the 1977 Montana State Legislature enacted and the governor signed into law legislation that has had a significant impact upon waste management in Montana.

The Montana Solid Waste Management Act, commonly referred to as Senate Bill 200, is an amended version of an existing state law. This act deals primarily with administrative and operational elements of solid and hazardous waste management systems. It requires all waste management systems in the state to be operated and maintained in a consistent and environmentally sound manner. Also, the act guarantees that the state's waste management practices are in substantive agreement with federal law.

The second new state law, the Solid Waste Management Act or Senate Bill 175 is permissive in nature. It is permissive in the sense that it directs the state to provide financial and technical assistance to local governments for the development of new or improved waste management systems. The act recognizes that no one implementation procedure is best for all situations in Montana. The statute acknowledges that cities, counties and the private sector are presently all engaged in various aspects of solid waste management, and these entities will continue to be actively involved in providing this public service. The law recognizes appropriate waste management systems must be tailored to meet particular local needs, and the primary responsibility for delivery of this service rests at the local level.

The Solid Waste Management Act also obligates the state to extend a level of financial and technical assistance to local governments desiring to initiate waste management systems. State financial assistance is regarded as a major impetus to local implementation. Without this assistance it is probable that many projects would not be initiated due to the lack of available financing.

Senate Bill 175 directed the DHES to develop a comprehensive state solid waste management plan. This plan has been com-

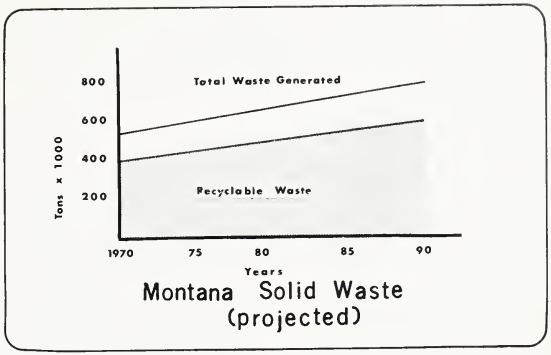
continued

POTENTIAL BENEFITS OF INCREASED RECYCLING

1. The extraction of virgin materials is becoming more costly in terms of capital requirements and environmental damage. Recycling post consumer waste materials can reduce these demands.
2. Substantial energy savings can be achieved by producing manufactured products from recycled materials.
3. Recycling provides a domestic source of materials.
4. Solid waste management represents a significant expenditure for local governments. Recycling will result in a smaller volume of wastes which will be easier to handle.

pleted, subjected to public review and adopted by the Board of Health and Environmental Sciences.

The purpose of the plan is to provide the state with the planning and implementation guidelines necessary to achieve a comprehensive statewide approach to solid and hazardous waste management. Neither the state plan nor state law dictate to local government what it must do in terms of waste management. Instead the state plan provides local governments with the means to determine and implement a system that best fits their needs and desires. The only stipulation for any local system is that the waste generated in its area be disposed in an environmentally sound manner.



Montana Solid Waste (projected)

Financial Assistance

As previously mentioned, it is mandatory that some form of financial assistance be extended to local governments which are willing to initiate solid waste planning and implementation activities. Accordingly, two forms of monetary aid are being extended to municipalities and counties: planning grants and organizational loans.

A. Planning Grants

State funds are being made available for local planning, including detailed engineering, fiscal and legal investigations which must be made for each local site specific project. The planning funds can be utilized for such activities as:

1. Contract negotiations between entities.
2. Predesign engineering and cost estimates.
3. Administrative costs.
4. Financial feasibility analysis.
5. Legal consultation, opinions and review of contracts.

B. Organizational Loans

State loans also will be available for the interim financing required during the period of time between confirming specific project feasibility and securing of permanent project financing. The loan funds are intended to be used for:

1. Initial operating capital.
2. Site evaluations and negotiations.
3. Final design engineering, cost estimates and construction contract documents.
4. Contract negotiations.
5. Financial and legal consultation.

Future Opportunities

Both federal and state laws provide a number of approaches for the creation of proper solid waste management. No single approach can solve the refuse problem. Rather, a variety of methods must be considered and used to assure the protection of public health and the environment, and achieve significant progress toward conserving our natural resources. As recently stated by the EPA in a report to Congress:

> *Regardless of their other specific merits or disadvantages, certain approaches are more appropriately undertaken at a national level, others at the state or local level. Some are more appropriate for small communities or rural areas, and some are best adopted for particular local markets.*

It is mandatory that those most affected by solid wastes be given the greatest opportunity to decide on the most appropriate solution to waste management problems. To achieve the proper management of solid wastes in Montana, a unique partnership has been formed between state and local governments. However, this partnership requires local governments to ultimately decide on the waste management solutions that are most compatible with local needs.

Nevertheless, for Montana this partnership will assure:

1. The appropriate protection of the environment by minimizing the impact of waste disposal.
2. The development of more effective and cost efficient waste management systems.
3. The further development of means to recycle and reclaim valuable materials from the waste stream.

Currently, 46 Montana counties and communities, in cooperation with the state, are actively conducting local site-specific planning for waste management systems. Also, it is anticipated that many more requests for state financial assistance will be received in the near future. This interest and willingness to improve such a vital public service is proof that the local-state partnership functions and functions well.

etc.

air

getting the drift

The Air Quality Bureau (AQB) has set up three monitoring sites near Scobey, Montana, to collect background information before two Canadian power plants on the Poplar River, north of the Montana-Canadian border, begin operation in 1979.

The three stations are monitoring particulates, sulfur dioxide and nitrogen oxide levels, and recording pertinent meteorological data for the area. These stations were set up to determine whether pollution could drift into the United States and violate ambient air standards or "use up" the region's allowable limits for industrial air pollution.

In addition to the air quality study, the AQB is engaged in five other studies for visibility, meteorology, soil chemical analysis, vegetation chemical analysis and coal analysis. Since the coal analysis requires samples which are not currently available, it is unlikely the coal study will reach completion.

Visibility, as it is used in this study, refers to the measurement of particles in the air rather than just what the human eye can see. The measurement is calculated from various meteorological measurements: wind speed, relative humidity, sky cover and total and direct solar radiation.

The soil analysis won't be completed unless other indications warrant it. Samples have been collected from the Scobey area and are being stored in the soil bank at Montana State University, Bozeman, pending comparison studies and chemical analysis when it is deemed necessary. The comparison will be with soil samples taken from the same areas after the Canadian utilities begin operation.

The background portion of the vegetation analysis is nearing completion and will give a quick check for air pollution changes in the Scobey area. Once the generating plants begin, new samples will be gathered and compared with the current results. Should the comparison show major differences, the soil analysis will likely be completed.

The final report on the first year's background study of the Poplar River area is scheduled to be completed April 1. Copies will be available from the Air Quality Bureau by mid-May.

unseen dangers?

The air sweeping across the Big Sky Country is not always as fresh and clean as it seems. Contaminated by dust and industrial pollutants it sometimes is left to stagnate in mountain valleys or accumulate near major cities, raising suspicions that the air some Montanans are breathing may be causing serious health problems.

continued

For many residents it seems far-fetched to think the great wash of pristine air gusting and swirling throughout the state could be causing health problems. However, information presented to the 1977 Montana Legislature by the Air Quality Bureau and local health departments convinced lawmakers to appropriate $1,070,000 for a two-year Montana Air Pollution Study (MAPS). The study began last year and will end in 1979.

MAPS hopes to find if there is a correlation between air pollution and health problems in selected areas of Montana. The study areas include Missoula, Butte, Anaconda, Billings, Columbia Falls, East Helena and the coal development area in southeastern Montana.

The idea for such a study germinated three years ago when a review of Montana death certificates by the bureau indicated the state's death rate for asthma, emphysema and bronchitis was more than 50 percent higher than the national rate. The rates were equally high for both males and females, indicating the problem may not have been job related, but rather an environmental problem such as air pollution.

The investigation of health effects has been divided into four related studies. These will include investigations into mortality, number of illnesses (or morbidity), genetic-carcinogenic factors and effects on the pulmonary system.

The mortality study, under the direction of the Air Quality Bureau, will be a preliminary investigation of the reasons for the high number of deaths from lung cancer and respiratory diseases in Deer Lodge, Silver Bow and Lake counties. Relatives of persons who died of lung cancer, chronic respiratory diseases and strokes will be interviewed to determine if any correlation can be drawn between the deaths and existing environmental conditions. If the study proves useful, it will be expanded to Missoula and Yellowstone counties.

The morbidity study, headed by Dr. Kit Johnson, Missoula, will analyze patient visits and hospital admissions for respiratory diseases in Missoula. The study will attempt to determine if there is a relationship between these respiratory diseases and air pollution. The study will expand to Butte, Anaconda and Billings if the Missoula investigation proves successful.

The genetic-carcinogenic study, under the direction of Dr. Guylyn Warren of the Chemistry Department, Montana State University, will be testing urine samples from people in Butte and Anaconda to determine if they have been exposed to concentrations of possible carcinogenic substances. The smelting and mining cities were selected due to the high incidences of lung cancer. The urine will be compared with samples from other Montana areas by using selected microorganisms known to be sensitive to mutagens and carcinogens in the urine.

The pulmonary studies in Missoula, under the direction of Dr. Johnson and the Missoula City-County Health Department, will test persons in Missoula known to have Chronic Obstructive Pulmonary Disease (COPD) and school children.

Approximately 100 COPD persons will be identified through the cooperation of local physicians, and changes in each person's breathing ability will be measured monthly. One-fourth of the people will be tested each week. The results of these tests will then be analyzed to determine if there is a correlation between breathing ability and air pollution changes.

The Missoula City-County Health Department and School District I will work together to test 500 to 600 third and fourth grade children. Each child will be given a simple breathing test once a month; again, approximately one-fourth of the subjects will be tested each week. An attempt to correlate the changes in the children's breathing with changes in air pollution will be made. The Missoula COPD and school children studies will be expanded to Butte, Anaconda and Billings during 1978-1979.

In addition to studying the relationship between air pollution, meteorological conditions and the effects on human health, the bureau will also develop data and modeling systems to predict future effects of air pollution.

polluters pay

During 1977 the Air Quality Bureau's Enforcement Section issued 40 citations, three notices of violation and seven orders to take corrective action. In connection with the enforcement actions the bureau collected $99,250.

occ health

two-faced element

Several years ago a Montana dentist asked the Occupational Health Bureau to check his office for possible mercury contamination. After a thorough investigation, it was discovered the dentist, two employes and a former employee all had slightly above normal amounts of mercury in their blood streams. Additionally, various areas in the office also registered high readings for concentrations of mercury vapors. After a thorough cleaning of the office carpets and a change of procedures in storing and handling mercury, the blood levels and vapors dropped to safe levels.

The dangers of mercury contamination attracted national attention in 1976 when it was learned after the mysterious death of a Kentucky dentist that the body contained an inordinately high amount of mercury.

The history of mercury or quicksilver dates back to the days of alchemy, when, due to its unusual properties, it had the mixed reputation of being both magical and sinister.

The element's toxic properties were alluded to in one of the world's better known children's stories, "Alice in Wonderland." The host of the Mad

continued

Hatter's tea party—the Mad Hatter—referred to a social commentary of the times. Mercury poisoning was known to be prevalent among hat makers. The element was used to shape the fabric, and when it vaporized during the process, it was frequently inhaled by the unsuspecting hat makers. Many developed a peculiar kind of insanity, characterized by incoherent babbling, tremors and, in some cases, death.

Felt hats are no longer made with mercury, however, it is still used by dentists to make silver amalgam for fillings.

Recognizing the possible danger of mercury contamination in dental offices, the Montana Dental Association and Dental Health and Occupational Health Bureaus of the Department of Health and Environmental Sciences have worked together closely to encourage dentists throughout the state to have their offices inspected.

To date, a total of 86 offices have been tested by state health officials. The majority of offices inspected showed below normal concentrations of mercury vapor; only one was near the maximum limit for vapor concentrations, 0.1 milligrams per cubic meter.

The danger of mercury contamination in dental offices applies mainly to dentists and dental employees rather than to patients. Office personnel work in the same environment day after day, and, if mercury is not being handled properly, they run the risk of contamination.

Montana dentists interested in having their offices inspected should contact the Dental Health or Occupational Health Bureaus in Helena.

water

planned protection

One of the most concerted efforts by local, state and federal governments to protect water quality in Montana is nearing the end of its initial planning stage.

The program, called Section 208 (Water Quality Management Planning), was created to protect water quality for present and future municipal, agricultural, industrial and recreational uses and to sustain fish, wildlife and other aquatic life.

The program was authorized by the Federal Water Pollution Control Act Amendments of 1972 in an attempt to find solutions to water quality problems caused by waste discharges and land use practices.

Congress made funds available to local and state governments through the U.S. Environmental Protection Agency (EPA) to develop appropriate water quality control programs and recommend ways of implementing the programs.

In Montana plans for water quality programs are being developed in four areas by local areawide planning organizations (APO) and for the remainder of the state by the Water Quality Bureau (WQB), Department of Health and Environmental Sciences.

The APOs are in the Flathead Valley, Gallatin-Madison River drainages, mid-Yellowstone area around Billings and the Yellowstone-Tongue River drainages.

The first draft plan was submitted last November by the Flathead Drainage APO and the first round of planning will be completed with the submittal of the drafft statewide plan early this summer.

The final plans will recommend to local, state and federal agencies water quality control measures to correct known water pollution problems and to protect existing high quality water in Montana. These recommendations must be technically feasible, acceptable to the public and workable by local and state governments.

The plans will be reviewed at the state level, certified by the governor and forwarded to EPA for review and certification. The adopted plans will provide the framework for a process to attain established water quality goals and objectives through effective management and regulating programs which will consider economic, social and environmental impacts.

subdivision

cutting review times

You might not realize it, but land development in Montana is big business and appears to be getting bigger every year.

Among the people and organizations which have kept an eye on this booming activity was the Montana Legislature. It was one of the first to recognize that this multi-million dollar business needed controls to protect public health. In 1961 the legislature took a major step forward when it passed the Sanitation in Subdivisions Act.

Essentially the act requires the Department of Health and Environmental Sciences (DHES) to review proposed developments to make sure future lot owners will have: 1) an adequate supply of water from a dependable source which is safe to drink; 2) a reliable, non-polluting sewage treatment system, and 3) a proper means for garbage disposal.

Subsequent legislatures took steps to further define the act, and in the course of these improvements the definition of the word "subdivision" was changed four times. With each change the number of land transactions reviewed by the DHES increased.

continued

During the 1960s an annual average of 50 subdivisions were reviewed. By 1970 the number started to climb. Within four years the total had increased to 319 a year.

In 1975 the department decided to create a bureau to handle the subdivision review responsibilities. The new Subdivision Bureau received a real baptism by fire. During the fiscal year (FY) 1975-76, the bureau reviewed 1,040 individual developments. The number increased to 1,870 last fiscal year, and it is anticipated the total will be nearly 2,200 by the end of FY 1977-78.

Reviewing more than 2,000 subdivisions a year is no easy task. The Subdivision Bureau is constantly working to ensure that proposed subdivisions are properly reviewed as quickly as possible.

During July 1976 it took the bureau approximately 57 working days to review major subdivisions (those with more than five lots) and 35 days for minor subdivisions (those with five lots or fewer). By July 1977 the time had been reduced to 32 days for major developments and 29 days for minors. The latest analysis, completed last December, revealed the review time had decreased to an average of 20 days for major and 10 days for minor subdivisions.

solid waste

valuable junkers

The Montana Junk Vehicle Program is more than a beautification project. In addition to removing repulsive junk vehicles from the landscape, the program helps conserve energy and natural resources.

Since its beginning in 1974, 36,234 vehicles have been collected and recycled; representing 38,969 tons of scrap metal. Aside from the revenue gained by the sale of this material, the recycling of junk vehicles is a significant energy-saver. The use of scrap ferrous metal reaps a substantial energy savings. Each 1,000 net tons of steel manufactured from ferrous scrap conserves the energy equivalent of 140,000 gallons of gasoline. Since its inception in Montana, the Junk Vehicle Program has conserved 4.46 million gallons of fuel.

In addition, there are significant environmental advantages to the use of ferrous scrap from junk vehicles in the steel making process. These advantages include:

—Reduction in air pollution by 86 percent.
—76 percent less water pollution.
—90 percent savings in virgin materials.
—Reduction in mining wastes by 97 percent.

recycle it!

Use it up,
Wear it out,
Make do,
Do Without!

That was a phrase from the great depression and the war years of the 1940s and one that is still true today. Almost all of us in one way or another have been affected by some form of recycling. Yet it is disturbing that recycling has been declining in this country.

A national commission charged with studying supplies and shortages recently reported that:

> Not all of the materials consumed can be economically recycled but present rates of recycling can be increased substantially, to supply a limited but important fraction of our total needs for materials.

Recycling can be an important part of the proper waste management. Any activity that recycles a portion of the total volume of waste reduces the amount that must be disposed of in a sanitary landfill. One Montana community that recently realized this was Helena.

Through the efforts of the community's Citizen Advisory Council and a force of dedicated volunteers, the city established a citywide newsprint recycling program. Helena's program is taking advantage of the current demand for cellulose insulation and requires citizens to separate newspapers in their homes for pick up by the city. The city's efforts can be viewed as a guide to other Montana communities.

The program is a product of detailed planning which assures the community a stable market, provides minimal capital outlays and equips Helena with the means to guarantee necessary public participation.

f&c safety

exotic allies

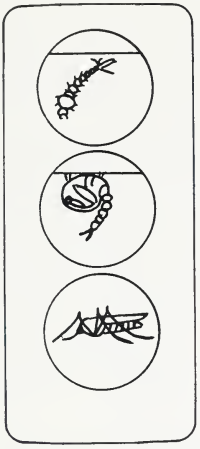
Exotic larvae-gulping mosquitofish were introduced to some eastern Montana waters last summer in hopes of reducing the amount of chemical spraying needed to control mosquitoes.

The program was initiated by the Vector Control Section of the Food and Consumer Safety Bureau, with the cooperation of the Department of Fish and Game, the federal Fish and Wildlife Service, participating Mosquito Control Districts and county and city governments.

Although only about two inches long, the tiny mosquitofish *(Gambusia affinis)* have voracious appetites. Their preferred diet is mosquito larvae, but they also eat small plants and animals.

continued

In the past, the Department of Health and Environmental Sciences (DHES) with authorization from the Department of Fish and Game selectively planted the fish in hopes of biologically controlling mosquitoes that might transmit encephalitis to animals or people. The new program planted fish on a much larger scale—a total of 11 counties were involved.



The DHES studies are aimed at developing practical and economic methods which will enable local mosquito districts and communities to integrate mosquitofish into established control programs. Generally speaking, a planting of mosquitofish is thought to equal about four chemical sprayings.

The small mosquitofish are plodding swimmers which don't like moving water and can't survive in cold water. Their ideal habitat is in warm bodies of water, such as warm springs, farm ponds, sloughs or old river ox bows. These areas are also prime breeding grounds for mosquitoes.

The non-native fish first turned up 18 years ago in warm water ponds in Granite County. It is thought the mosquitofish were illegally introduced from a home aquarium.

Since their discovery, experiments have revealed that the fish appear not to pose a threat to native fish and often provide food for larger fish and waterfowl.

Based on the successful plantings last summer, the program will be expanded this summer to include:

—The integration of mosquitofish to mosquito control activities in more counties.

—Attempts to streamline the paperwork necessary for local districts to obtain trapping and transplanting permits.

—Determine the tolerances of the fish to adapt to a variety of different environments.

—Study environmental impacts associated with the plantings.

—See how efficiently the fish control mosquitoes in flooded areas.

Additionally, the Vector Control Section is asking all the counties participating in the program and those wishing to participate to identify perennial warm springs which could serve as wintering areas for mosquitofish. Without such areas the fish die when cold weather lowers the water temperature. Persons knowing of such springs should contact Dr. Ken Quickenden or Van Jamison of the Vector Control Section, Food and Consumer Safety Bureau, Board of Health Building, Helena, Montana 59601.

etc.. etc.

finding relief

If you discover a fly in your soup, a cute little "thing" doing the backstroke in your glass of water or find it necessary to strap on a gasmask to get a breath of fresh air, you don't necessarily have to come to Helena to find relief.

The Environmental Sciences Division has two branch offices which extend environmental health services to the western and eastern parts of Montana. Situated in Kalispell and Billings, the offices offer a variety of services.

The Kalispell office is managed by Wilbur Aikin, P.E., and situated in the M&M Building, Main and Second. The office staff helps the public with subdivision, water quality and air quality matters. Established in 1969, the six member office covers an area which extends south to Lake and Sanders counties, west to the Idaho border, north to the Canadian Line and laps over the Continental Divide into Glacier County to the east.

The head of the Billings office is Alf Hulteng, P.E. The office is at 3304 Second Avenue North, and offers assistance in food and consumer safety, water quality and air quality matters.

Established in 1963, the eight member Billings office covers an area bounded by the Wyoming border to the south, west to Livingston, north to Malta and east to the North Dakota line.

Both offices work closely with the division's Helena office, enabling each to draw on a wide range of sources to help solve various environmental health problems.

If you find you or your community need some advice or assistance, the persons to contact are:

Kalispell Office: (755-5521)
Aikin—Subdivisions
J.D. Peterson—Air Quality
Bill Sherman—Water Quality

Billings Office: (255-5697)
Hulteng—Water Quality
George Perusich—Air Quality
Frank Gessaman, R.S.—Food & Consumer Safety

environmental chalkboard

AGRICULTURAL POLLUTION: The liquid and solid wastes from all types of farming, including runoff from pesticides, fertilizers and feedlots; erosion and dust from plowing; animal manure and carcasses, and crop residues and debris. It has been estimated agricultural pollution in the U.S. has amounted to more than 2.5 billion tons per year.

AIR POLLUTION: The presence of contaminants in the air in concentrations that prevent the normal dispersive ability of the air and that interfere directly or indirectly with man's health, safety or comfort or with the full use and enjoyment of his property.

AMBIENT AIR: Any unconfined portion of the atmosphere; the outside air.

BACTERIA: Single-celled microorganisms that lack chlorophyll. Some bacteria are capable of causing human, animal or plant diseases, others are essential in pollution control because they break down organic matter in the air and water.

BIODEGRADABLE: The process of decomposing quickly as a result of the action of microorganisms.

continued

BIOSPHERE: The portion of the earth and its atmosphere capable of supporting life.
CARCINOGENIC: Cancer producing.
DUMP: A land site where solid waste is disposed of in a manner that does not protect the environment.
EFFLUENT: A discharge of pollutants into the environment, partially or completely treated or in its natural state. Generally used in regard to discharges into waters.

FOSSIL FUELS: Coal, oil and natural gas; so-called because they are derived from the remains of ancient plant and animal life.
GREENHOUSE EFFECT: The heating effect of the atmosphere on the earth. Light waves from the sun pass through the air and are absorbed by the earth. The earth then reradiates this energy as heat waves that are absorbed by the air, specifically by carbon dioxide (CO^2). The air thus behaves like glass in a greenhouse, allowing the passage of light but not of heat. Thus many scientists theorize that an increase in the atmospheric concentration of CO^2 can eventually cause an increase in the earth's surface temperature.

LIMNOLOGY: The study of the physical, chemical, meteorological and biological aspects of fresh water.
MONITORING: Periodic or continuous determination of the amount of pollutants or radioactive contamination present in the environment.

OPACITY: The degree light is obscured. For example, a clean window has zero opacity; a wall is 100 percent opaque. The Ringelmann system of evaluating smoke density is based on opacity.
PAN: Peroxyacetyl nitrate, a pollutant created by the action of sunlight on hydrocarbons and nitrogen oxides in the air. PAN is an integral part of photochemical smog.
PARTICULATES: Finely divided solid or liquid particles in the air or in an emission. Particulates include dust, smoke, fumes, mist, spray and fog.
POTABLE WATER: Water suitable for drinking or cooking purposes from both health and aesthetic considerations.
RESOURCE RECOVERY: The process of obtaining materials or energy, particularly from solid waste.
RIVER BASIN: The total area drained by a river and its tributaries.
STATIONARY SOURCE: A pollution emitter that is fixed rather than moving, such as an automobile.
TOXICITY: The quality or degree of being poisonous or harmful to plant or animal life.
WATER TABLE: The upper level of ground water.

——U.S. ENVIRONMENTAL PROTECTION AGENCY

authors' corner

The authors of the stories in this issue of Montana Environmental Sciences represent all the disciplines found in the Environmental Sciences Division.

Ben Wake's discussion of the health and wealth associated with the construction of pollution control equipment is backed by years of work in the environmental health field. Ben is the administrator of the division, and has seen the interest in environmental health grow from a small number of persons to the present staff of about 115 persons.

Doug McDonald is a health physicist for the Occupational Health Bureau and has first-hand knowledge of the BENT and DENT programs.

A statistician for the Air Quality Bureau, Jerry Schneider also proves to be an able author. A relatively new addition to the bureau, Jerry has worked in the air quality field for a little more than a year.

Jim Peterson's advice about inspecting restaurants comes from a great deal of experience. A registered sanitarian, Jim heads the Food Service Establishments, Licensing and Enforcement Sections of the Food and Consumer Safety Bureau.

Educated as a geological engineer, there are few people who know more about land development in the picturesque Flathead than Will Aikin. In addition to his work with the Subdivision Bureau, Will also heads the division's Kalispell office.

The team of authors who guided us through the toxic bloom drama combine a variety of talents. Biologist Loren Bahls and Limnologist Abe Horpestad, both Ph.D.s, work for the Water Quality Bureau. Steve Glasser is a U.S. Forest Service hydrologist working for the Gallatin National Forest in Bozeman.

Writer/photographer Bill Potts is an information officer for the Solid Waste Bureau. Bill uses his combined talents effectively in his efforts to inform and educate the public.

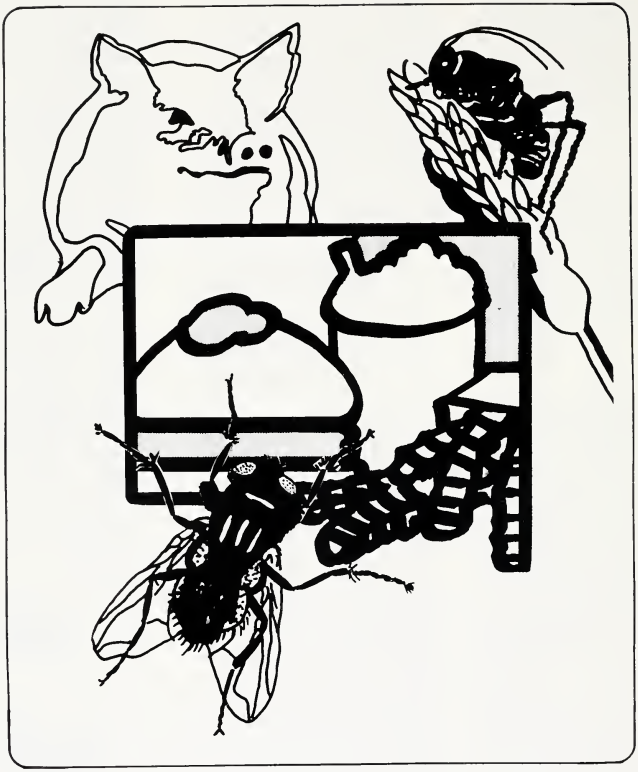
When it comes to product safety, registered sanitarian Cal Campbell is one of the most knowledgeable in Montana. An interesting man with an equally interesting job, his office in the Food and Consumer Safety Bureau abounds with samples of mislabled products.

WATER RESOURCES

Montana has within its borders portions of three major drainage systems. West of the Continental Divide the streams drain via the Columbia River into the Pacific Ocean; east of the divide the streams drain via the Missouri-Mississippi Rivers into the Gulf of Mexico, and from portions of Glacier National Park and Teton County streams drain via the Belly and St. Mary Rivers into Hudson Bay. The Triple Divide, where water flows in all three directions, is located in Glacier National Park.

LARGEST LAKE

Innumerable mountain lakes vary from glacial pot holes to Flathead Lake, the largest natural fresh water body included in one state west of the Mississippi. . .188 square miles of surface area.



by Cal Campbell, R.S.

For worms in halibut, gum in potato chips or misleading labels call. . .

Did you ever find a bug in a can of soup; a clump of hair in your soft drink; a label that was false or misleading, or other similar problems with food, drugs or cosmetics? If you have, your should immediately report the incident to your local health department.

The local health department will examine the problem and investigate the source of the product. If the problem has not occurred locally, the incident will be reported to the Food and Consumer Safety Bureau, Department of Health and Environmental Sciences (DHES). The bureau will in turn contact the Federal Food and Drug Administration (FDA), U.S. Department of Agriculture (USDA) or other federal or state agencies, which will notify the proper people and agencies in other states.

Last year the Food and Consumer Safety Bureau received 300 product complaints. The following incidents are a sampling of some of those complaints:

Smoked halibut with worms - 1/6/77

(Bozeman) - The smoked halibut contained at least three worms. Laboratory analysis indicated the worms were anisakid nematodes—(they are not human parasites). This problem was reported to FDA for follow-up with the processor, no further problems occurred with this product.

Potato chips with bubble gum - 1/14/77

(Billings) - Persons reported a potato chip bag had a large gob of material causing the potato chips to stick together. Examination of the product indicated bubble gum was the mysterious substance. This problem was reported to the state where the potato chips were made and to FDA which contacted the manufacturer.

Mushrooms with glass - 1/18/77

(Laurel) - A customer found a large piece of glass in a bottle of mushrooms. The problem was reported to FDA for follow-up at the mushroom packaging plant. It was found that glass bottles had exploded causing glass to fly into filled containers. Metal guards were placed on the filler to eliminate the problem.

Labeling complaint

(Helena) - Eggs were found to contain an information panel claiming the eggs reduced cholesterol in blood.

continued

The egg labeling problem was reported to the State Department of Livestock, Dairy and Egg Division, for discussion with the producer-processor. The false and misleading labeling was eliminated.

Suspected food-borne illness - 1/25/77

A doctor reported two small children were ill as a result of eating chip dip. The store was immediately asked to cease sale of the product until an investigation could be made. The investigation did not indicate any food-borne illness bacteria. The product from the home did indicate a problem of food poisoning bacteria. Further investigation revealed dogs and cats were eating out of the same chip dip bowl as the two youngsters.

Bread sticks with insects - 1/27/77

(Great Falls) - Packages of bread sticks were reported to have been infested with insects. Inspection of the store showed no other bread sticks of the same brand were infested. The problem was reported to FDA for reporting to the United States Customs, since it was an imported product.

Swollen cans of mushrooms - 1/30/77

Customers complained of a store selling swollen cans of mushrooms. The local health department investigated the complaint and discovered there were swollen cans of low acid foods on the store shelf. Inadequate rotation of canned goods was responsible for the contaminated cans being on the shelves. The swollen cans were landfilled and stock rotation practiced.

Outdated baby formula - 2/6/77

(Glasgow) - A person with an ill child complained about the formula they were feeding the child. The food was thought to be at least four years old. However, investigation of the product showed the freshness date code was February, 1978, instead of February, 1973 as originally thought, because of the blurring of the freshness date code. The baby food was found not to have caused the illness.

Bread with metal belt connector - 2/17/77

(Helena) - A person reported a metal staple in the bread. Examination of the metal indicated it was a belt connector. The problem was reported to the bakery, which immediately repaired the belt.

Pretzels with lye - 2/8/77

(Statewide) - Two-hundred seventy-two cases of pretzels were improperly processed and contaminated with lye. They were collected by the wholesaler and destroyed.

Unsolicited vitamins - 3/2/77

(Butte and Billings) - Unsolicited multiple vitamin capsules with mistletoe ingredients (which are toxic) were delivered by parcel post to residents in Butte and Billings. This product was reported to FDA for followup with the manufacturer and distributor. Immediate corrections were made. The company is no longer in business.

Snack food with hair - 3/15/77

(Great Falls) - The snack foods contained many colored hairs. No other bag in the same coded lot was affected. This problem was reported to FDA for discussion with the manufacturers, since it appeared that sweepings had been put into the food. The problem was quickly abated.

Soft drink with fly - 3/6/77

(Wolf Point) - A fly was discovered in a bottle of soft drink. The bottle came from another location in the state. The health department in the location of the soft drink plant was notified and an inspection made. Proper fly screening and fly control methods were installed in the plant.

Candy with glass - 3/2/77

(Great Falls) - Candy was reported to have crystals of glass in it. Examination of the candy indicated the problem was crystalized honey and sugar.

Apricots with crickets - 3/25/77

(Circle) - The opening of a can of apricots revealed a cricket floating in the liquid. This was reported to FDA for follow-up at the point of manufacturing.

Salmon with suspected food-borne illness - 4/18/77

(Hardin) - Two persons reported being ill after tasting some salmon. Laboratory analysis of the salmon indicated a possible food poisoning case. This problem was reported to the Department of the Interior, Division of Fisheries, which is responsible for correcting such situations.

Short weight hamburger - 4/22/77

(Billings) - It was reported that the hamburger patties did not weigh what they were claimed to weigh. This was reported to the Bureau of Weights and Measures, and between the local health department and the Weights and Measures Division the problem was solved.

Train wreck - 4/22/77

(Billings) - Forty-thousand pounds of flour in 5, 10, and 50-pound bags were badly damaged due to a railroad derailment. Since there was heavy damage to the containers and contamination, 30,000 pounds of flour were disposed of in the Billings landfills. Train wrecks and truck wrecks are investigated thoroughly in an attempt to prevent contaminated, adulterated foods from reaching the market.

Swollen green bean cans - 5/17/77

(Darby) - It was noted there were cases of swollen canned green beans. Any time swollen cans are discovered, they must be reported and the product disposed of, due to the danger of botulism. Botulism is a fatal disease, whereas other food poisonings cause severe illness, but not necessarily death. Botulism bacteria can grow in conditions where there is little air or in vacuums. No swollen can of low acid foods, such as corn, beans or peas should be consumed.

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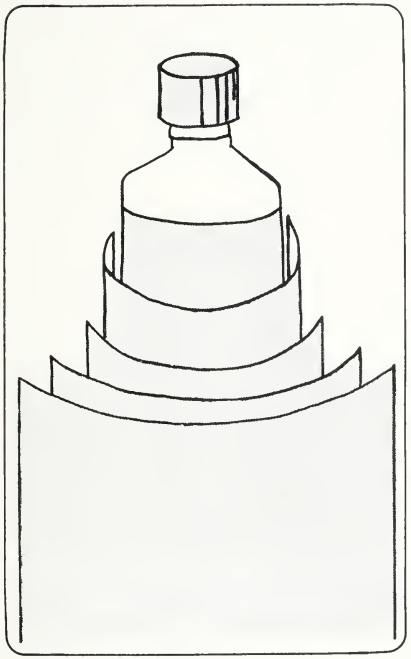

Copper bracelets - 6/3/77

(Great Falls) - A complaint was received that copper bracelets were being advertised to prevent arthritis, rheumatism and everything from baldness to ingrown toenails. The problem was reported to FDA for talks with the manufacturer.

Suspected food-borne illness - 8/3/77

Persons complained of becoming ill after eating liver sausage. The investigation showed the sausage had been left in a hot car all afternoon, then consumed that evening. Approximately eight hours later people complained of being ill. Laboratory analysis indicated food poisoning. The product should not have been consumed after being left in the hot car where the bacteria could grow.

Stale breakfast cereals - 8/14/77

Some people who purchased breakfast cereal in a local grocery store, took it home and noted it was stale. They took the product back to the store, but the store would not accept it. Investigation revealed that all breakfast cereals in the store were very old. The products were removed from the shelves by the local health department.

Rubber material in a loaf of bread - 8/26/77

(Great Falls) - A person reported that a loaf of bread had a large, four inch by six inch piece of rubber through several slices. Investigation showed the rubber was from an inspection port of a flour bin. The rubber gasket had dropped into the flour bin during an inspection of the bin. The problem had not been reported to management.

Hamburger with extenders - 9/23/77

(Glasgow) - It was reported to the county sanitarian that a retail market was receiving hamburger with soy extenders from a USDA inspected plant. This problem was reported to the USDA for discussion of the matter with plant officials. The plant was in another state.

Halloween candy - 11/1/77

A doctor reported a patient had become ill after eating Halloween candy. It appeared to the doctor that the candy had been altered with a drug. This problem was reported to the Drug Abuse Bureau for investigation.

Cereal with insects - 12/12/77

A person reported finding insects in his breakfast cereal. He said he bought the product at a local store, however, an investigation showed it was not from that store. Additionally, he had the product in his home for several months.

A cereal has a shelf expectancy of 60-90 days from the date of manufacturing when stored at a temperature above 65°F. Insects lay eggs on the cereal grains in the field. The eggs remain dormant until the grain is made into cereal. The insects will hatch if the product is not rotated in the store or home.

Food employee with staphylococcus infection - 12/19/77

A doctor reported he had ordered an employee of a meat packing plant not to work with the food because of the danger of spreading the infection. The employee was not cooperative. The bureau notified the USDA, since the plant is under its inspection, and also contacted the employer. This infection could have spread to food products causing severe food-borne illnesses.

The employee was given work in another area until his infection was cured.

Oysters with worms - 12/22/77

(Missoula) - Persons complained of receiving a very large worm in a can of oysters. The worm was not parasitic. The Division of Fisheries, Department of Interior, was notified for follow-up since it was an imported product.

Hopefully these examples will encourage consumers to immediately notify local health departments if they suspect an illness was caused by a contaminated product. Early notification means the situation can be investigated promptly, often preventing further problems. Most businesses do not want to sell products which endanger public health. It is true accidents or sabotage can occur, but such instances can be kept to a minimum by quick reporting to the proper authorities.

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